

IMAGE QUANTIZER
Operating Instruction Sheet



25X1

Supplement 3 to Report No. TO-B 69-16

6 March 1969

25X1

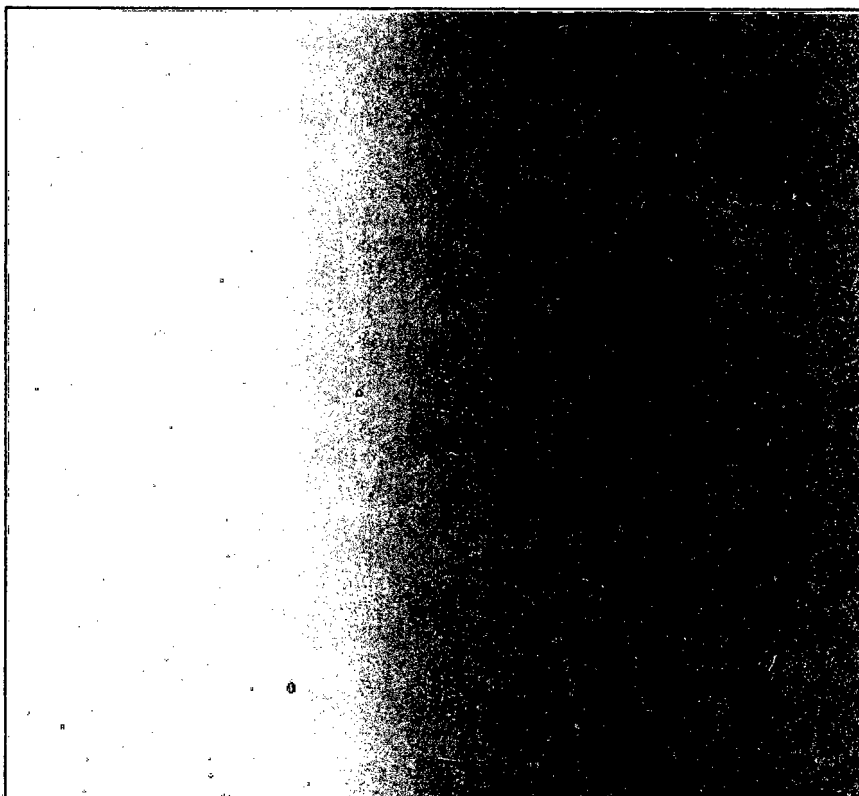
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INTRODUCTION

The Image Quantizer (IQ) is a high-speed film-base transparency reading device capable of scanning an 8-1/2 x 11 inch specimen in 8 minutes at a raster frequency of 200 lines per inch. Raster frequencies of 400 and 600 lines per inch are also available at 16- and 24-minute scan time, respectively.

A precision glass drum is used as the specimen table. A light source and condenser lens are supported on a track within the drum. Mounted on a second track beneath the drum are a scanning objective, aperture holder, and photomultiplier assembly. The two assemblies are connected by a stainless-steel band and pulley assembly. This arrangement maintains the optical alignment of the scanning aperture and the light source.

The film specimen, when taped to the drum, lies in the object plane of the objective. The IQ is supplied with apertures ranging from 0.2 to 2.0 mm to permit scanning of a wide range of specimen types.

The Image Quantizer is designed to cover a range of 0 to 3D density units. The range of 3D is divided into 64 separate levels of 0.047D per step. The range control allows reduction of the scanning range down to 0.64D or 0.01D per step. A density level control, used in conjunction with the range control, sets the start of the scanning range at any point between 0 and 3D.

A wire stylus pulsed at a 18 kHz rate prints out the code on electrosensitive paper mounted on an aluminum drum. This printout is a repetitive four-level code: white, light gray, dark gray, and black in order of decreasing density. A contrast control adjusts the shading of the output code to a readable level. A meter and function selector switch provide the necessary monitors to set up the IQ properly for a particular specimen.

The Image Quantizer has three modes of operation:

Digital X. The digital X mode of operation produces a direct quantized output of 64 discrete levels in a four-shade repetitive code. Note that the density per level is a function of the density range control.

Digital X'. The digital X' mode of operation produces the derivative of the quantized output in the form of contour lines at the mid-level and crossover points of each of 64 discrete density levels.

Analog X'. The analog X' mode of operation produces the quantized derivative of the photomultiplier amplifier output. The output format is the same as the digital X mode of operation. The differential time constant can be varied in decade steps by the front panel control.

OPERATING PROCEDURE

BASIC CONTROL SETTINGS

For proper operation of the Image Quantizer the controls must be correctly set and adjusted. In setting up the IQ for operation, make the following initial control settings.

1. Turn the MINIMUM DENSITY control to the full counterclockwise position (a setting of zero).
2. Turn the DENSITY RANGE control to the full clockwise position (a setting of 10).
3. Turn the MODE OUTPUT selector switch to the DIGITAL X position.
4. Turn the CONTRAST control to the full clockwise position.
5. On the printer control panel set the SCAN control to 200 lines per inch.
(This control is to the right of the meter on the upper portion of the housing.)

These settings place the IQ in its maximum range of about 3D (three density units), and the instrument is now ready to scan in the direct quantize mode at a rate of 200 lines per inch.

The POWER ON switch energizes the entire system electronics; the POWER ON indicator light is illuminated when the power is applied. After a 45-second warmup period, the HIGH VOLTAGE READY light (red) on the control panel illuminates to indicate that the plate voltage has been applied to the photomultiplier. The IQ is now ready.

Select a medium size aperture and place it in the slot in the photomultiplier assembly. Be sure that the aperture is firmly in place and held by the ball detent to assure no light leaks. By removing the door on the right side of the printer-scanner front panel, access may be gained to the photomultiplier.

The remaining controls on the IQ control panel are not used at this time. These controls and their functions are:

1. DIFFERENTIAL TIME CONSTANT - This control adjusts the differential time constant in decade steps from 0.01 to 0.0001. It is only operational in the Analog X' mode of operation.
2. Meter, METER FUNCTION Selector Switch, and ZERO CALIBRATE - These items on the panel are used to set up a particular specimen when range and minimum density level adjustments are desired.
 - a. With the METER FUNCTION switch in the MIN DENSITY position and the ZERO CALIBRATE control depressed, the meter indicates the minimum density level from 0D to 3D. Interpolation of the meter scale is necessary.
 - b. With the METER FUNCTION switch in the INPUT MONITOR position, the output of the photomultiplier amplifier is monitored. The absolute specimen density can be determined from the meter indication when it is compared with the calibration curve supplied.
 - c. With the METER FUNCTION switch in the DENSITY RANGE position, the output of the range and level amplifier is monitored. Since the response of the meter is slower than the pulse rate being monitored, only a relative indication of the mid-range of operation can be determined.

NOTE

The MINIMUM DENSITY control is affected by the DENSITY RANGE control; consequently, it should be adjusted after the DENSITY RANGE control is set to the desired density per step.

Tape the specimen to the glass drum. Do not place the specimen or the tape in the narrow clear area between the two black lines on the drum.

Move the scanning carriage to the left hand edge of the specimen by moving the indicator handle below the specimen drum. Move the scanning stop to the right hand edge of the specimen. These are located in the top and bottom slots of the scanning scale, respectively. When the IQ scanning carriage reaches the end stop, it will shut off automatically. The scanning process may be stopped at any time by depressing the DENSITY button provided.

Place a sheet of Gestefax copy paper, smooth side facing out, on the printing drum and lock it in place with the holding bar provided. Be sure that the holding bar is firmly in place so that it will not loosen and fall out during operation.

NOTE

Possible damage to the stylus holder, photomultiplier, and glass drum could result if the holding bar loosens during operation.

To start the scanning process, turn the operating knob, located in the center of the upper panel, clockwise until it latches in place. The IQ will automatically start to scan. The operating knob turns on the scanning motor, engages the magnetic drive clutch, and places the stylus against the printing drum.

COMPLEX OPERATION

After the basic setup and initial run has been made, sensitivity of the IQ may be increased by adjusting the DENSITY RANGE and MINIMUM DENSITY controls.

NOTE

The density level (MINIMUM DENSITY) control is dependent upon the DENSITY RANGE setting. Use the meter to adjust these controls as described elsewhere in these instructions.

As an example, suppose a given specimen sample is to have a density range of 2D with a minimum density of 1D. If all 64 contour levels are to be in the 2D range, the DENSITY RANGE control should be set at approximately 6.0. To set the mini-

imum density component to 1D, the density level control must be adjusted. This is accomplished by use of the meter. Scanning of the film at these settings will produce the desired 64 increments over the 2D range. This corresponds to a 0.031D per step sensitivity.

DIFFERENTIAL MODE OPERATION

When differential output is desired, place the MODE OUTPUT selector switch to the ANALOG X' position. Turn the MINIMUM DENSITY level control to zero, and adjust the DENSITY RANGE control to the desired sensitivity. The MINIMUM DENSITY level control is not used in this mode of operation. Select one of the three differential time constants by setting the DIFFERENTIAL TIME CONSTANT control to 0.01, 0.001, or 0.0001. The machine may be operated in the same manner as before.

The time constant settings, IQ sensitivity, and aperture size in this mode of operation depend upon the rate of change of density on the film specimen being scanned. The operator must adjust the machine for best results in this mode of operation.

NOTE

The differential sampled is only in the direction of scan. Rotating the film specimen 90 degrees would produce a different printout.

ADDITIONAL CONTROLS

A bandpass filter cutoff switch is located within the cabinet on the sweet circuit chassis. The IQ has been designed to operate at 10 kHz; since system noise increases with bandwidth, however, this control has been provided so that the operator can reduce the bandwidth of the photomultiplier circuitry to reduce the noise output even further. This is desirable for specimens that have a slow change in density levels.

A gain adjustment control is provided on the same chassis, although it is not marked or shown in the illustrations. This control has been set to cover a range of 3D and to produce a sensitivity of 0.01D per step. If this control is turned clockwise, it reduces the maximum density range and increases the sensitivity proportionally.

SPECIFICATIONS

Illumination	Transmission
Maximum Density Range	3.0D
Minimum Density Range	0.6D
Minimum Sensitivity	0.047D
Maximum Sensitivity	0.0094D
Quantizable Steps	64
Linearity	$\pm 2.5\%$
Printout	Four shades (white, light grey, dark grey, and black) on electrosensitive paper
Specimen Area	8 1/2 x 11 in.
Printed Speed	Resolution 200 ℓ /in. - 8 min Resolution 400 ℓ /in. - 16 min Resolution 600 ℓ /in. - 24 min
Input Data	Transparencies only
Output Modes	Quantized Derivative quantized 0.01, 0.001, 0.0001 time constants
Scanning Apertures	0.5 to 10 mm
Bandwidth	20 kHz, settable in steps to 2.5 kHz
Scanning Resolution	5 ℓ /mm

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